

2.0 SCOPE AND APPLICABILITY

This manual is directed towards evaluation of proposed discharges of dredged material (associated with navigational dredging or dredging activities of essentially the same character as navigational dredging) in open water. It utilizes both chemical and biological analyses as necessary, to provide effects-based conclusions within a tiered framework with regard to the potential for contaminant-related water column, benthic toxicity and benthic bioaccumulation impacts. The tiered-testing procedure detailed in Section 3.1 is comprised of four levels (tiers) of increasing investigative intensity which generate information to assist in making contaminant-related determinations. Tiers I and II use existing or easily acquired information and apply relatively inexpensive and rapid tests to predict environmental effects. Tiers III and IV contain biological evaluations which are more intensive and require field sampling, laboratory testing, and rigorous data analysis.

2.1 This Manual is Intended to Address:

- contaminant-related impacts associated with discharges of dredged material (resulting from navigational dredging or dredging activities of essentially the same character as navigation dredging, such as open water discharges of dredged material excavated from a soft-bottom flood control channel or reservoir) in open water disposal areas, including wetlands.
- contaminant-related impacts to waters of the U.S. associated with dredged material runoff from confined disposal areas. Guidance on evaluation of such discharges is provided in Appendix B.

2.2 This Manual is Not Intended to Address:

- impacts associated with the dredging activity itself.
 - impacts associated with dredged material discharges associated with excavation of drainage ditches and landclearing.
 - impacts associated with the discharge of fill material. However, where dredged material associated with navigational dredging will be discharged in open water as fill, the procedures of this manual are applicable.
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- microbiological impacts except for impacts in conjunction with the State designated use of a waterbody and human health considerations. The manual provides a list of applicable references, as the technology for analyzing other potential impacts from microorganisms (e.g., modeling potential pathways of contamination) is in various stages of development. Although scientifically accepted mechanisms for predicting the degree of potential microbiological impacts are not yet available, site management techniques are available (but are beyond the scope of this manual) to address potential impacts (e.g., aerating dredged material to kill anaerobic organisms).

2.3 Dredged Material Discharge for Beneficial Uses

The testing procedures in this manual should also be applied when navigational dredged material is proposed for certain beneficial uses. To the extent that dredged material will be discharged into open water in conjunction with a beneficial use and the evaluation of its suitability requires analysis of contaminant-related impacts listed in 2.1, the testing protocols of this manual should be applied. However, other evaluations may be necessary, in addition to those in this manual, to assess the potential for contaminant-related impacts through pathways other than those provided by open water. For example, contaminants in dredged material proposed for wetlands creation which will not adversely affect the open water environment, may be taken up by wetlands vegetation, thereby requiring evaluations that are not detailed in this manual.

This manual may also apply to dredged material used for beach nourishment. Beach nourishment normally involves hydraulic or mechanical placement of uncontaminated materials near a shoreline. As with other beneficial uses, dredged material proposed for beach nourishment often can be excluded from chemical or biological testing; the focus is on analysis to determine physical compatibility as measured by grain size and total organic carbon (see Section 9.1). However, if there is a reason to believe that contaminants are present, further evaluation should be performed.

2.4 The Role of Biological Evaluations (Toxicity and/or Bioaccumulation Tests) in the Manual

As noted in Section 230.61 of the Guidelines, the evaluation process will usually entail investigation of potential biological effects, rather than merely chemical presence, of the possible contaminants. Biological evaluations serve to integrate the chemical and biological interactions of the suite of contaminants which may be present in a dredged material sample, including their availability for biological uptake, by

measuring their effects on test organisms. Within the constraints of experimental conditions and the endpoints of effects measured, biological evaluations provide for a quantitative comparison of the potential effects of a dredged material when compared to reference sediments. Thus, a specified level of change compared to reference conditions and a statistically significant result in this comparison indicate that the discharge of the dredged material in question may cause a direct and specific biological effect under test conditions and, therefore, has the potential to cause an ecologically undesirable impact. Guidance for the conduct of biological tests is given in Sections 11 and 12.

Dredged material potentially contains a myriad of chemical contaminants which may adversely impact aquatic organisms. The literature is replete with examples where aquatic organism sensitivity varies with the type of contaminant (e.g., see Rand and Petrocelli, 1985) and, as a result, a suite of aquatic species are routinely recommended to fully assess the impact of contaminants on a biological community. In this manual, three sensitive species are recommended for the water column and whole sediment toxicity tests. In the case of the latter, two species can be used, provided they cover three functional characteristics: filter feeder, deposit feeder, burrower. In both cases, at least one of these species must be a sensitive "benchmark" species. For assessing bioaccumulation, adequate tissue biomass and the ability to ingest sediments is more important than taxon sensitivity. Where possible, two species should be used to assess potential bioaccumulation unless adequate regional data are available to justify single species testing.

It is important to recognize that dredged material bioassays (toxicity and bioaccumulation tests) are subject to interpretation and are not precise predictors of environmental effects. This manual does not provide quantitative guidance on interpreting the ecological meaning of such effects (e.g., the ecological consequences of a given tissue concentration of a bioaccumulated contaminant or the consequences of that body burden to the animal). Rather, the manual considers statistically significant increases above certain levels compared to the reference sediment as potentially undesirable. Because a statistically significant difference is not a quantitative prediction that an ecologically important impact would occur in the field or vice versa, this manual discusses additional factors to be weighed in evaluating potential ecological impact. This is more likely to result in environmentally sound evaluations than is reliance on statistical significance alone.

Bioaccumulation evaluations indicate biological availability of contaminants in dredged material, which may bioaccumulate and bioconcentrate in (or, for a few chemicals, biomagnify up) aquatic food webs to levels which might be harmful to consumers, including human beings, without killing the intermediate organisms. To use bioaccumulation data, it is necessary to predict whether there will be a cause-and-effect relationship between the animal's exposure to dredged material and a meaningful adverse elevation of body burden of contaminants above that of similar animals not exposed to the dredged material.

2.5 The Role of Water and Sediment Chemical Evaluations in the Manual

Chemical evaluations of water and sediments are conducted for the following reasons:

- to determine contaminant concentrations in the dredged material
- to determine contaminant concentrations in the discharge or reference sites
- to determine compliance with water quality standards (WQS).

Chemical evaluations may be made on the basis of previous chemical inventories, when there is a reason to believe that the dredged material contains no new contaminants, or that there is no difference between contaminants in the dredged material and the disposal site [Tier I; Section 230.60(a)-(c) of the Guidelines]. The latter may be the case where the discharge site is adjacent to the dredging site, and potential differences in contaminant bioavailability are considered unlikely. There may, however, be concern with potential water column effects which would warrant evaluation of such potential effects (Tier II; Section 2.6). In particular, it must be shown that unacceptable levels of dissolved and suspended contaminants from the discharge either will not be released and transported to less contaminated areas, or can be managed.

Initial evaluation of water column chemistry may be carried out through the use of a numerical dispersion model based on bulk sediment chemistry (Section 5.1.1). If this model indicates the potential for adverse effects, a chemical evaluation of potential water column effects may be conducted through the use of elutriate tests [Tier II; Section 230.61(b)(2) of the Guidelines]. In this procedure an aqueous extract (i.e., an elutriate) is prepared from the material to be discharged, and the dissolved contaminants are compared to water quality standards with consideration of mixing. This comparison requires that dissolved contaminants in reference water (ambient condition) also be analyzed.

The above elutriate test is used to determine compliance with WQS with consideration of mixing. The elutriate test provides an indirect evaluation of potential biological effects, because WQS are derived from toxicity tests of solutions of various contaminants. Even if WQS are met, biological evaluations (see Section 2.4) must be considered.

2.6 Water Column Effects

The dredged material impact in the water column must be within the available WQS for all contaminants of concern outside of the mixing zone. If disposal operations result in long-term exposures, compliance with chronic aquatic and/or human health standards should be evaluated. Wildlife standards, if available, should also be considered. Water column toxicity tests are used to provide information on the toxicity

of contaminants not included in water quality standards, and also to indicate possible interactive effects of multiple contaminants.

2.7 Mixing

Appendix C describes the method to be used for estimating the effect of mixing for water column evaluations. 40 CFR 230.11(f)(2) describes the factors to be considered in defining mixing zones; States may use additional factors in such definition. This method is applied in evaluating the potential for impacts of the portion of dredged material that remains in the water column; all water quality and water column toxicity data must be interpreted in light of mixing [Section 230.61 (b)(2)(ii) of the Guidelines]. This is necessary because biological effects (which are the basis for WQS) are a function of the biologically available contaminant concentration and exposure time of the organisms. Laboratory toxicity tests expose organisms to specific concentrations for fixed periods of time, whereas in the field both concentration and exposure time to contaminants change continuously due to mixing and dilution. Both factors interact to control the degree of biological impact. Thus, it is necessary to incorporate the mixing expected at the discharge site into the interpretation of data.

2.8 Benthic Effects

Generally, the greatest potential for environmental effects from dredged material discharge lies in the benthic environment. Deposited dredged material is not mixed and dispersed as rapidly or as greatly as the portion of the material that may remain in the water column, and bottom dwelling animals living and feeding on deposited material for extended periods represent the most likely pathways by which adverse effects to aquatic biota can occur. Therefore, the major evaluative effort must be placed on deposited material and the benthic environment, unless there is a compelling reason to do otherwise. The approach in this manual is conservative (i.e., protective) as it uses whole-sediment bioassays (toxicity and bioaccumulation tests) to evaluate the solid phase of the dredged material. Sediment chemical analyses currently cannot be used to directly evaluate the biological effects of any contaminants which may be present in dredged material because such potential effects are a function of bioavailability. However, as noted in Section 2.5, there are circumstances where it may be reasonably assumed that bioavailability in the dredged material and the discharge site are similar. When decisions cannot be made using evaluations in Section 230.60 of the Guidelines, bioaccumulation tests should be used to directly determine the bioavailability of potential contaminants.

2.9 Management Options

Some dredged material evaluated in accordance with technical procedures in this manual may demonstrate

a potential for unacceptable environmental impacts or not meet Federally approved State WQS. If so, a careful case-by-case evaluation of management options (e.g., alternative dredging and discharge methods, alternative discharge sites, confined disposal, capping, site controls such as covers and/or liners) will be necessary to determine whether the proposed discharge can be made acceptable or can be brought into compliance with the Guidelines and State WQS. As previously noted, it is beyond the scope of this manual to determine whether a material which would not otherwise comply with the Guidelines, could be brought into compliance through appropriate management actions or other discharge methods.

2.10 The Relationship of the Inland Testing Manual to Other USACE/EPA Dredged Material Management Efforts

2.10.1 Relationship of the Manual to the USACE/EPA Framework Document

EPA and USACE have long recognized the need for a consistent technical framework for decision-making regarding the discharge of dredged material in ocean, near coastal, and inland waters (e.g., see Francingues et al., 1985; Wright and Saunders, 1990). This manual is one of a series of guidance documents jointly developed by EPA and the USACE in response to that recognition. This series of guidance documents includes the "Evaluating Environmental Effects of Dredged Material Management Alternatives - A Technical Framework" (USACE/EPA, 1992) which articulates those factors (including the potential for and degree of contaminant-related impacts) to be considered in identifying the environmental effects of dredged material management alternatives on a continuum from uplands to oceans, and which meet the substantive and procedural requirements of NEPA, CWA and MPRSA. The companion testing manual for ocean disposal, the Green Book (EPA/USACE, 1991) is included in the series. Application of the testing guidance in this manual within the context of the Framework Document will allow for consistency in decision-making with respect to technical considerations, across statutory boundaries and with consideration of the continuum of dredged material discharge options.

2.10.2 Relationship of the Manual to the EPA/USACE Green Book

Although the Ocean Dumping and the CWA programs carry out their functions under different mandates and different environments (estuarine, lake and riverine *versus* ocean), there is a considerable overlap in terms of practical application. The Guidelines are statutorily directed to be based upon criteria comparable to those developed under Section 403(c) for the territorial seas, contiguous zone, and ocean. Additionally, in previous guidance both EPA and USACE have acknowledged the ecological similarity of all aquatic areas and the need for a consistent technological analysis framework, particularly when the waters of the

United States under consideration for a discharge are near-coastal. While details of this manual are necessarily different from one addressing only ocean waters, the tiered testing framework and concepts of the Green Book are an appropriate paradigm. The Inland Testing Manual also utilizes the Green Book's reference site approach which provides a more accurate data base for cumulative impact analysis.

Dredged material transported for purposes of dumping or disposal seaward of the baseline of the territorial sea will continue to be regulated under the MPRSA (commonly referred to as the Ocean Dumping Act). MPRSA-regulated dredged material disposal will be tested in accordance with procedures outlined in the Green Book (EPA/USACE, 1991). As previously discussed, dredged material used as fill within the territorial sea, such as for beach nourishment, is regulated under the CWA and will be tested in accordance with this manual.

2.10.3 Relationship of the Manual to EPA's Contaminated Sediment Strategy and Sediment Quality Criteria

EPA is developing a Contaminated Sediment Management Strategy (Strategy; Southerland et al., 1992) which is a multi-program effort to address contaminated aquatic sediments in the United States. The Strategy is intended to improve the understanding of the extent and severity of sediment contamination and to propose prevention, control, and remediation programs. The Strategy describes the policy framework and specific actions EPA could take to promote the consideration of and reduction of ecological and human health risks posed by sediment contamination. The Strategy also recommends a comprehensive research program and outreach activities with other agencies and the general public.

One component of the Strategy is the development of Sediment Quality Criteria (SQC), which are derived numerical values representing the concentration of chemicals in sediment which are determined to adversely affect benthic organisms. SQC are included in EPA's approach to defining contamination in sediments, and are envisioned to play a range of roles in all programs, from assessment to remediation. When finalized, SQC likely will be incorporated into the Inland Testing Manual in Tier II. SQC could also form the basis for State SQS. The Inland Testing Manual is structured such that evolving science may be readily merged into the document.
